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Tube-formed rock bolt

The present invention relates to a tube-formed rock bolt with closed profile, which is inserted in a bore hole and then expanded into contact with the wall of the bore hole through plastic deformation by means of internal pressurisation.

In a previously known rock bolt, see e.g. US-A-4 509 889, a comparatively thin-walled tube of mild steel is used, which during manufacture is deformed such that its peripheral length is larger than the circumference of the bore hole. A drawback with this formation is that the tube is relatively thin-walled in order to allow deformation against the wall of the bore hole. This gives a comparatively small cross-sectional area, which restricts the tensile strength of the rock bolt. The unsymmetrical form of the rock bolt gives as result that the contact force against the rock varies along the periphery, which limits the load carrying capacity. A further drawback is that the steel material is exerted to corrosion attack.

The present invention, which is defined in the subsequent claims, aims at achieving a tube-formed rock bolt having a substantially higher tensile strength. This is achieved primarily because the rock bolt comprises a tube, which has a material thickness varying along the periphery. Through this one can increase the cross-sectional area of the tube substantially at the same time as one has parts, which are easily deformed so that the rock bolt gets a secure grip against the wall of the bore hole. The advantageous embodiments of the invention given in the subclaims give as results that the rock bolt obtains good corrosion resistance, is easy to manufacture and gives a good contact force against the wall of the bore hole around the hole.

Two embodiments of the invention are described below with reference to the accompanying drawings in which fig 1 shows a tube-formed rock bolt in perspective with one end closure removed in order to show the cross-sectional form. Fig 2 shows a cross section through the bolt according to fig 1 and schematically the surrounding bore hole in which the rock bolt is to be anchored. Fig 3 shows an alternative embodiment of the invention.

The tube-formed rock bolt shown in the drawings comprises an elongated tube 1 provided with two end closures 2,3. In the shown example the end closures are made as caps, which sealingly have been connected with the tube 1. Through this a room 5 is created between the tube 1 and the end closures 2,3. This room can be pressurised via a passage 4 at the end closure 2. The end closures can be achieved in other ways. The essential is that the ends of the tube 1 are sealed so that one through pressurisation of the room 5 can expand the tube 1 to contact against the bore hole 11. The tube 1 is, for instance, made by means of extrusion of an aluminium-based material, e.g. EN-AW 6082-T4. The tube 1 can thereby advantageously be given cross-sectional forms like those shown in figs 2 and 3. By making the profile symmetrical relative to the longitudinal sections 6,7 one obtains a relatively even distribution of the contact force between the tube 1 and the bore hole 11 after expansion of the bolt. One obtains about the same result with the bolt form shown in fig 3. This means that the bolt can be loaded more heavily without gliding in the bore hole. The bolt shown in fig 2 comprises four substantially triangularly formed parts 8, which have large cross-sectional areas and thus large stiffness and tensile strength. These parts are connected by means of U-shaped deformation parts 9. In order to increase the flexibility the tube profile has been provided with a number of circularly formed parts 12 at the deformation parts 9.

When a rock bolt is to be anchored in a bore hole the bolt is pushed into the bore hole with the end closure 3 at the inner end of the bore hole. Then pressure fluid is supplied via the passage 4 to the room 5 surrounded by the tube 1. Through this the tube 1 is expanded so that it contacts the wall of the bore hole 11 hardly. Then the room 5 is unloaded whereby the tube 1 remains firmly anchored, since the previous expansion has deformed the tube 1 plastically.

The invention can, of course, be varied within the scope of claim 1. The profile can, for instance, have more or fewer than four stiff parts. An example of this is shown in fig 3.